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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/670,487	09/25/2003	Ji Ung Lee	132614-1	8005

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EXAMINER

ROY, SIKHA

ART UNIT	PAPER NUMBER
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2879

DATE MAILED: 08/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/670,487

Applicant(s)

LEE ET AL.

Examiner

Sikha Roy

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 69-99 is/are pending in the application.
- 4a) Of the above claim(s) 1-68 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 69-80 and 84-99 is/are rejected.
- 7) ☒ Claim(s) 81-83 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

The Response, filed on May 30, 2006 has been entered and acknowledged by the Examiner.

Claim Objections

Claim 99 is objected to because of the following informalities: The limitations reciting 'a first end of said isolation tube is seated within a recess formed within a top electrode portion of said RF electrode assembly; and a second end of said isolation tube is sealed against a showerhead of said RF electrode assembly' do not have antecedent basis and was not present in the original claim 99. It appears to the examiner that these four lines at the end of claim 99 do not belong to this claim and hence claim 99 is examined omitting these limitations.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 69-72, 79, 80, 84, 86, 88, 93-96 and 99 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,494,179 to Hori et al.

Regarding claim 69 Hori discloses (Fig. 8h column 11 lines 10-57) a self-aligned gated field emission device comprising a substrate 121 having a surface and predetermined thickness, a porous layer 130 having a surface and predetermined thickness disposed adjacent to the surface of the substrate, wherein the porous layer 130 defines a plurality of substantially cylindrical channels each of the plurality of channels being parallel to each other and substantially perpendicular to the surface of the substrate, a plurality of substantially rod-shaped structures 130 disposed within at least a portion of the substantially cylindrical channels defined by the porous layer 130 and adjacent to the surface of the substrate wherein the a portion of each of the plurality of rod-shaped structures protrudes above the surface of the porous layer, a gate dielectric layer 132 having a surface and predetermined thickness disposed on the surface of the porous layer wherein the gate dielectric layer is disposed between the plurality of substantially rod-shaped structures, a conductive layer 133 (gate electrode) having a surface and a predetermined thickness disposed on the surface of the gate dielectric layer 132 wherein the conductive layer is selectively disposed between the rod-shaped structures.

Regarding claims 70 and 71 Hori discloses (column 11 line 37, claim 16) the substrate is made of silicon, a semiconductor material.

Regarding claim 72 Hori discloses (column 6 lines 64-67) the substrate comprising tungsten (W).

Regarding claim 79 Hori discloses (claim 17) the plurality of rod shaped structure produced from the metal substrate (tantalum substrate) and hence comprises a metal.

Regarding claim 80 Hori discloses the metal comprising Ta.

Regarding claim 84 Hori discloses the rod-shaped structures have diameter far less than 100nm which includes values less than 60nm.

Regarding claim 86 Hori discloses(column 9 lines 29-31) the gate dielectric layer comprising silicon oxide layer.

Regarding claim 88 Hori discloses the gate conductive layer comprising metal.

Regarding claim 93 Hori discloses (column 15 lines 36-44) the field emission device can be used in a flat display device.

Regarding claim 94 and 99 Hori discloses all the limitations same as of claim 69 and additionally Hori discloses (column 15 lines 36-44) the gated field emission device is used in a field emission display device, an electronic system.

Regarding claim 95 and 96 Hori discloses the gated field emission device is an x-ray imaging system.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 73, 76,87 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,494,179 to Hori et al.

Regarding claim 73 Hori discloses the claimed invention except for the limitation of thickness of the substrate being between 1 micron and 550 micron. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. It is noted that the thickness of the substrate is selected so that it supports the porous layer along with the rod-shaped structures. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the thickness of the substrate between 1 micron and 550 micron so that it supports the anodized porous layer along with the rod-shaped structures, since optimization of workable ranges is considered within the skill of the art.

Regarding claim 76 Hori discloses the claimed invention except for the limitation of the thickness of the porous layer between 0.5 and 5 microns. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the thickness of the porous layer between 0.5 micron and 5 micron so that it supports the rod-shaped structures, since optimization of workable ranges is considered within the skill of the art.

Regarding claim 87 Hori discloses the claimed invention except for the limitation of the thickness of the gate dielectric layer between 1nm and 25 nm. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105

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USPQ 233. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the thickness of the gate dielectric layer between 1nm and 25 nm so that it supports the gate conductive layer, since optimization of workable ranges is considered within the skill of the art.

Claims 74,75,77 and 78 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,494,179 to Hori et al. and further in view of U.S. Patent 6,278,231 to Iwasaki et al.

Regarding claim 74 Hori discloses the porous layer comprising silicon oxide and does not exemplify it comprising anodized metal oxide.

Iwasaki in analogous art of nano-structure electron-emitting device discloses (Figs. 1,2 and 18 column 7 lines 1-17, column 19 lines 36-39) nanostructure comprising semiconductor substrate 11, a porous layer with anodized aluminum oxide film 13 defining a plurality of substantially cylindrical channels and rod-shaped nanostructures disposed within the channels. Iwasaki further teaches (column 3 lines 46-65) this configuration of nano-structures can be produced in a highly reliable fashion.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to substitute the silicon oxide layer of Hori by anodized metal oxide layer with cylindrical channels and nanotubes disposed within the channels as taught by Iwasaki for providing an electron emitting device which can be produced in a highly reliable fashion.

Regarding claim 75 Iwasaki discloses the porous layer comprising anodized aluminum oxide.

Regarding claim 77 Iwasaki discloses (column 17 lines 28,29) the diameter of the plurality of substantially cylindrical channels (nano holes) is about 50 nm.

Regarding claim 78 Iwasaki discloses (column 9 lines 51-61) the length (depth) of the plurality of substantially cylindrical channels is in the range of .01micron (10nm) to 100 micron.

Claims 89, 91 and 92 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,494,179 to Hori et al. and further in view of U.S. Patent 6,911,767 to Takai.

Regarding claim 89 Hori does not exemplify the metal for gate electrode layer comprising one of Nb, Pt, Al, W, Mo, Ti, Ni, and Cr.

Takai discloses (column 9 lines 58-62) the conductive layer (second metal film) comprises metal selected from titanium, chrome. The selection of known material for a known purpose is considered to be within the skill of the art. Therefore it would have been obvious to one of ordinary skill in the art to use one of the metals Nb, Pt, Al, W, Mo, Ti, Ni, and Cr for the gate conducting layer of Hori depending on the suitability of intended use.

Regarding claim 91 Takai discloses (column 9 lines 61,62) the thickness of the conductive layer (second metal film) is 200nm (0.2 micron).

Hori and Takai disclose the claimed invention except for the limitation of thickness of the gate conductive layer being between 20nm and 100 nm. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the thickness of the grid between 20nm and 100 nm so that it is close proximity of the aligned rod-shaped structures, and thus provides high emission current since optimization of workable ranges is considered within the skill of the art.

Regarding claim 92 Takai discloses (column 10 lines 1-4) the distance between the plurality of rod-shaped structures (same as the distance between the fine holes through which plurality of nanotubes protrude) is 2000nm (2 micron).

Hori and Takai disclose the claimed invention except for the limitation of the rod shaped structures being separated by a distance of about 50nm and 500nm. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. It is to be noted that the number of plurality of rod-shaped emitters and hence emission current increases as the distance between them is reduced. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the distance between 50nm and 500 nm so that there

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is increased number of plurality of emitters and hence increased emission current since optimization of workable ranges is considered within the skill of the art.

Claim 90 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,494,179 to Hori et al. and further in view of U.S. Patent 6,504,292 to Choi et al.

Regarding claim 90 Hori does not disclose the conductive gate layer comprising semiconductor material.

Choi in same field of endeavor discloses (column 7 lines 45-47) the grid conductor formed of semiconductor materials such as silicon carbide. The selection of known material for a known purpose is considered to be within the skill of the art. It would have been obvious to use semiconductor material for the gate conductive layer because the selection of known material for a known purpose is within the skill of the art.

Claims 97 and 98 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,494,179 to Hori et al. and further in view of Applicant's admitted prior art (AAPA).

Regarding claims 97 and 98 Hori does not disclose explicitly the electronic system self-aligned gated field emission device being a fluorescent lighting system.

AAPA discloses (Background of the Invention section [0003]) use of electron emission device as an electron source in a gas discharge lighting and fluorescent lighting system for providing longer life.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use the self-aligned gated field emission device with increased longevity of emitter tips of Hori as an electron source in a fluorescent lighting as disclosed by AAPA for providing longer life of the lighting device.

Allowable Subject Matter

Claims 81-83 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claims 81-83, U.S. Patent 6,504,292 to Choi et al. discloses the use of dielectric material for the substantially rod-shaped structure. But there is no motivation to combine Choi with the cylindrical silicon emitters of Hori. Thus the prior art of record does not render obvious the rod-shaped structures comprising dielectric material.

Claims 82,83 would be allowable because of their dependency status from claim 81.

Response to Arguments

Applicant's arguments with respect to claim 69 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent 6,642,639 to Choi et al. and U.S. Patent 6,769,945 to Chang et al. disclose triode type field emission structure having carbon emitters formed on a cathode layer on the substrate.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sikha Roy whose telephone number is (571) 272-2463. The examiner can normally be reached on Monday-Friday 8:00 a.m. – 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar D. Patel can be reached on (571) 272-2457. The fax phone number for the organization is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sikha Roy

Sikha Roy
Patent Examiner
Art Unit 2879